

What is claimed is:

1. A power supply apparatus comprising:

5 a DC power supply for converting a first AC voltage from an AC power supply to a main DC voltage;

a DC-to-AC converter for converting said main DC voltage to a second AC voltage alternating between positive and negative polarities, said second AC voltage being adapted to be applied to a load via first and second output terminals of said power supply apparatus;

10 a superposition voltage supply for generating a negative voltage to be applied to said load via said first and second output terminals, said negative voltage being generated at a time of transition of said second AC voltage from positive to negative and lasting for a period shorter than a period during which said second AC voltage is negative, said negative voltage having a negative peak value larger than a negative peak value of said second AC voltage and
15 changing rapidly from said negative peak value;

said superposition voltage supply comprising an auxiliary voltage supply generating a DC voltage having a negative peak value larger than said negative peak value of said second AC voltage, switching means rendered conductive for
20 said period shorter than said period during which said second AC voltage is negative, and a current-limiting resistor connected in series with said switching means;

said superposition voltage supply causing a current to flow from said auxiliary voltage supply through said switching means, said current-limiting resistor and said first and second output terminals when said switching means is
25 conductive; and

a differentiating circuit connected in parallel with said current-limiting resistor, said differentiating circuit including a resistor having a smaller resistance value than said current-limiting resistor.

2. The power supply apparatus according to Claim 1 wherein said differentiating circuit comprises a series combination of said resistor and a capacitor, said capacitor having such a capacitance value that charging of said capacitor can be completed in a time shorter than the period during which said
5 switching means is conductive.

3. The power supply apparatus according to Claim 1 wherein said auxiliary voltage supply includes a smoothing capacitor in an output thereof.

10 4. The power supply apparatus according to Claim 1 wherein:
said DC power supply is an AC-to-DC converter to which said first AC voltage is applied as an input thereto and converts said first AC voltage to said main DC voltage; and
said auxiliary voltage supply converts said first AC voltage to said DC
15 voltage having a negative peak value larger than said negative peak value of said second AC voltage.

5. The power supply apparatus according to Claim 1 wherein said auxiliary voltage supply is a voltage-booster for boosting a DC voltage supplied thereto
20 from said DC power supply.

6. The power supply apparatus according to Claim 1 wherein said auxiliary voltage supply comprises:
an auxiliary voltage supply input-side rectifying and smoothing circuit for
25 rectifying and smoothing said first AC voltage to produce a DC voltage;
an auxiliary voltage supply high-frequency inverter for converting said DC voltage supplied from said auxiliary voltage supply input-side rectifying and smoothing circuit to a high-frequency voltage;
an auxiliary voltage supply high-frequency transformer for boosting said
30 high-frequency voltage; and

an auxiliary voltage supply output-side rectifying and smoothing circuit for rectifying and smoothing said boosted high-frequency voltage.

7. The power supply apparatus according to Claim 1 wherein:

5 said DC power supply comprises:

an input-side rectifying and smoothing circuit for rectifying and smoothing said first AC voltage to produce a DC voltage;

a high-frequency inverter for converting said DC voltage supplied from said input-side rectifying and smoothing circuit to a high-frequency voltage;

10 a high-frequency transformer for boosting said high-frequency voltage; and

an output-side rectifying and smoothing circuit for rectifying and smoothing said boosted high-frequency voltage to produce said main DC voltage; and

15 said auxiliary voltage supply comprises:

an auxiliary voltage supply high-frequency inverter coupled to said input-side rectifying and smoothing circuit for converting said DC voltage supplied from said input-side rectifying and smoothing circuit to a high-frequency voltage;

20 an auxiliary voltage supply high-frequency transformer for boosting said high-frequency voltage supplied from said auxiliary voltage supply high-frequency inverter; and

an auxiliary voltage supply output-side rectifying and smoothing circuit for rectifying and smoothing said boosted high-frequency voltage supplied from
25 said auxiliary voltage supply high-frequency transformer.

8. The power supply apparatus according to Claim 1 wherein:

said DC power supply comprises:

an input-side rectifying and smoothing circuit for rectifying and
30 smoothing said first AC voltage to produce a DC voltage;

a high-frequency inverter for converting said DC voltage supplied from said input-side rectifying and smoothing circuit to a high-frequency voltage;

a high-frequency transformer for boosting said high-frequency voltage;

and

5 an output-side rectifying and smoothing circuit for rectifying and smoothing said boosted high-frequency voltage to produce said main DC voltage; and

said auxiliary voltage supply comprises:

10 an auxiliary voltage supply high-frequency transformer coupled to said high-frequency inverter for boosting said high-frequency voltage supplied from said high-frequency inverter; and

an auxiliary voltage supply output-side rectifying and smoothing circuit for rectifying and smoothing said boosted high-frequency voltage supplied from said auxiliary voltage supply high-frequency transformer.

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9. The power supply apparatus according to Claim 1 wherein:

said DC power supply comprises:

an input-side rectifying and smoothing circuit for rectifying and smoothing said first AC voltage to produce a DC voltage;

20 a high-frequency inverter for converting said DC voltage supplied from said input-side rectifying and smoothing circuit to a high-frequency voltage;

a high-frequency transformer having first and second secondary windings in which first and second boosted high-frequency voltages resulting from boosting said high-frequency voltage supplied from said high-frequency inverter are induced, respectively; and

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an output-side rectifying and smoothing circuit for rectifying and smoothing said boosted high-frequency voltage induced in said first secondary winding to produce said main DC voltage; and

said auxiliary voltage supply comprises:

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an auxiliary voltage supply output-side rectifying and smoothing circuit

for rectifying and smoothing said boosted high-frequency voltage induced in said second secondary winding of said high-frequency transformer.